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Review Article

ANALYSIS OF CONFORMAL TRIPLE NOTCH ANTENNA FOR C, X AND KU BAND COMMUNICATION

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Abstract
A compact conformal antenna for wireless communication applications is proposed in this paper. For the basic antenna element, bending analysis at 15, 30 and 45 degrees is discussed. The proposed antenna dimensions are 26x24x1.6 mm^3. Flexible material Rogers Ultralam is used as substrate material in HFSS simulation. Simulation results of planar antenna and the proposed conformal antenna at different bending angles are investigated and analyzed. The results show that the proposed antenna has good antenna performance parameters even for different bending angles and thus this antenna can be integrated on to any surface for various wireless applications.

Keywords: Antenna performance parameters, Bending angles, Conformal antenna, HFSS simulation, Wireless applications.

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INTRODUCTION

The design of microstrip antenna for modern telecommunication and satellite communication with compact and conformal structure is the big challenge for researchers [1-4]. The conformal antennas may suffer with losses associated with material, connector and mismatched platforms etc[5-9]. Attaining notch bands for blocking unnecessary bands and making them adoptable to communication applications with conformability needs novel structures[10-14]. People designed notch band antennas, conformal antennas and compact antennas for various applications [15-26]. This article is the combination of all these attributes for attaining best possible solution to modern communication systems.

ANTENNA DESIGN

To validate the flexibility of the planar basic antenna shown in Figure 1., conformal structures are developed at different bending angles of 15^0, 30^0 and 45^0. The proposed conformal models at 15^0, 30^0 and 45^0 developed in HFSS simulator is given in Figure 2(i), (ii) and (iii) respectively. The proposed antenna dimensions are 26x24x1.6 mm^3. The material used for substrate in HFSS is Rogers Ultralam as it is flexible. The radiating element contains truncated rectangular patch with U-slots etched. The ground plane contains defected ground structure with two cross etched.

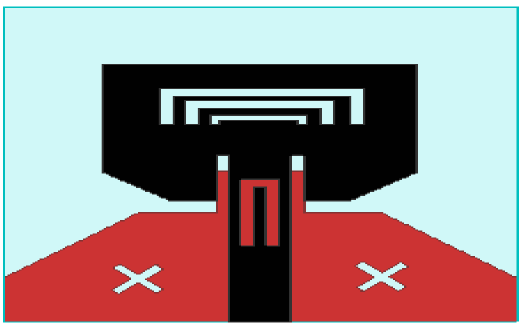
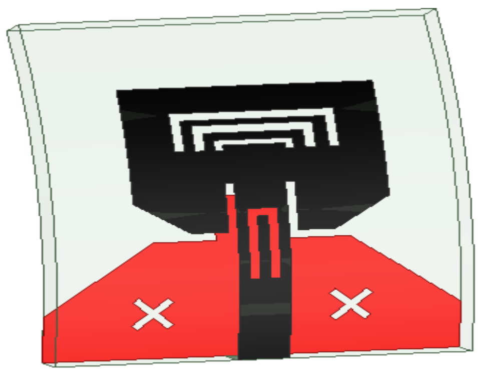
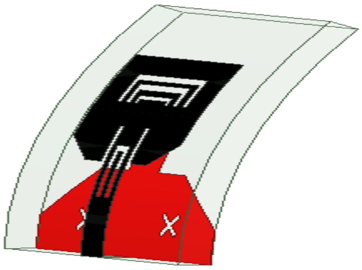


Figure 1. Planar basic antenna

(i) Conformal structure for 15^0 bending angle



(ii) Conformal structure for 30^0 bending angle



(iii) Conformal structure for 45⁰ bending angle

Figure 2. Proposed conformal antenna for 30⁰ bending angle

RESULTS AND DISCUSSIONS

Simulated S11 characteristics of basic antenna and the proposed conformal antenna models are illustrated in Figure 3. The basic antenna operates from 4.2 to 7.8 GHz with notch at 6.1 GHz and from 11.8 to 15.8 GHz. The electrical properties of the antenna have changed due to curvature in conformal models and thus the operating band of the developed conformal models are shifted slightly. Models with 15⁰ and 30⁰ bending exhibit similarity with the basic element but the conformal model with 45⁰ bending has deviated more.

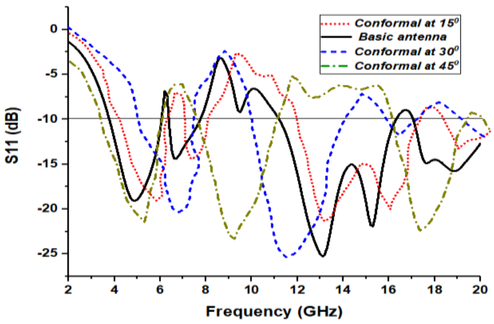


Figure 3. S11 characteristics of basic antenna and proposed conformal models

3D gain (dB) of the basic antenna and proposed conformal model at 30⁰ are illustrated in Figure 4 (i) and (ii) respectively. Basic antenna achieved a gain of 4.3 dB where as the proposed conformal antenna has achieved a gain of 4.57 dB.

Peak gain vs frequency characteristics of the basic and proposed conformal models are presented in Figure 5. Figure 6 describes the radiation efficiency vs frequency characteristics of basic antenna and conformal models. From these figures it can be observed that conformal antennas with 15⁰ and 30⁰ bending angles exhibit better characteristics compared to conformal antenna with 45⁰ bending angle.

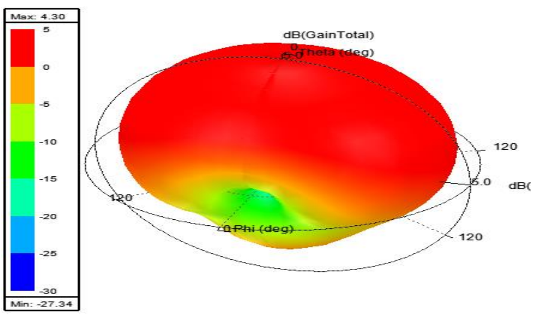


Figure 4. (i) 3D gain of basic antenna

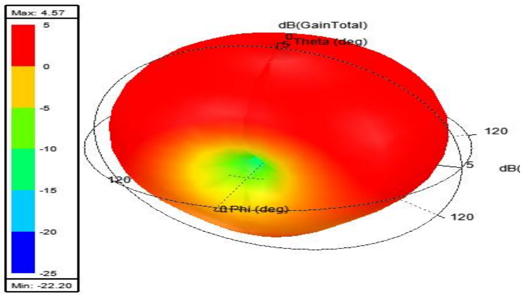


Figure 4. (ii) 3D gain of proposed conformal model at 30⁰

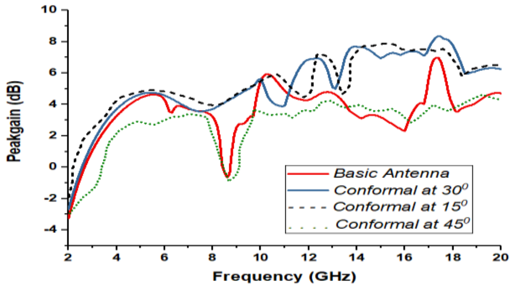


Figure 5. Gain Vs frequency characteristics

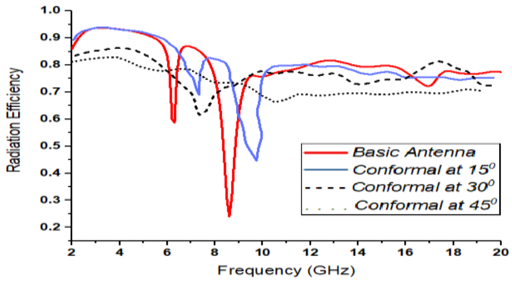


Figure 6. Radiation efficiency Vs frequency characteristics

CONCLUSIONS

In this paper, conformal models of basic monopole antenna with different bending angles are developed in HFSS simulator. Simulation results of these models interms of S11 characteristics, 3D gain plots, peak gain vs frequency characteristics and radiation efficiency vs frequency characteristics are investigated and analyzed. The analysis of these results conclude that the conformal models with 15⁰ and 30⁰ bending angles exhibit better characteristics than that of model with 45⁰ bending angle. Hence, the proposed conformal models are suitable for integration on to curved surfaces for various wireless applications.

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